

hairs on each side of a median line and several scattered, smaller ones. Metathorax with a transverse row of chitinous hairs, three on either side of a median shallow depression.

Abdominal segments each bear a row of dorsal, transversely placed chitinous hairs, four of them being closely placed on either side of middle on all but seventh segment which bears three closely placed ones. Ultimate segment with two lateral tubercles each bearing a group of four long, chitinous, downwardly directed hairs. All hairs becoming longer posteriorly. Large lateral spiracle on prothorax. Length of pupa about 10 mm. Width, 3-4 mm.

Adult. This was described by Illiger in 1791 (Schneid. Mag. V. 1791, 613). Blatchley and Leng (Rhyn. N. E. Amer. 1916, p. 550) give a redescription of the beetle and state that it occurs over the entire United States. In Leng's "Catalogue of the Coleoptera of America North of Mexico," two varieties based on color are listed, these being *pulchellus* (Schon.) and *quinquepunctatus* (Say). The species is variable insofar as its spots are concerned and this variation is probably responsible for the nine synonyms listed in this catalogue. Chittenden (loc. cit.) has observed two chalcidid parasites, one being *Habrocytus rhodobaeni* Ash.

The Anal Veins in the Wings of Diptera.†

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The students of Diptera as a rule recognize only a single anal vein. Some exception is found to this in the superfamily Tipuloidea where most, if not all, species have at least two easily recognized anal veins. To the first of these Osten-Sacken applied the name of axillary and to the second the name of spurious. This terminology is used by Williston in the last edition of his *Manual*.

Osten-Sacken, although he figures the wings of forty species of Tipulidae, shows in only a few cases an additional anal vein to the two just named and one of these figures, the wings of *Gnophomyia tristissima*, is the only figure of a tipulid wing showing this additional anal vein accurately.

Needham, in his paper on the wings of the Tipulidae, recog-

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nizes only two anal veins. The additional vein is not shown on a single one of his many figures, many of which are very inaccurate for the anal region. This additional anal vein, however, can be readily identified on each of the six figures of wings reproduced from photographs. This additional vein is not shown on any of the over two hundred and fifty wings of Tipuloidea figured by Alexander.

Redtenbacher, the first author to use a uniform system for the naming of the veins of the wings of insects, in his classic paper on the wings of insects, *Flügelgeader der Insecten*, shows fairly accurately the three anal veins in a wing of a *Tipula*, but it is doubtful if he appreciated the full significance of his figure.

Comstock in his *Manual* shows in practically every figure this additional anal vein. It should now be stated that this additional anal vein is the first anal vein or *1st A*. The figure of *Protoplasa* which shows only a single anal vein was copied from Osten-Sacken. It is very inaccurate in the anal region. For this wing, as well as all the wings of the Tanyderidae, contains three anal veins. While the artist, who made the figures of Comstock, was consistent in showing the first anal vein in practically every wing, he has rarely drawn this vein accurately. Attention should be called to the fact that Comstock did not recognize the structure here designated as the first anal as a distinct vein, but only as a fold, the anal fold.

Comstock and Needham in the *Wings of Insects* have not departed from the interpretation given by Comstock in his *Manual*. The drawings used in making the figures for the *Manual*, relabelled with their new system of letters instead of the numbers used by Redtenbacher, are used.

Comstock in *The Wings of Insects* has the following to say about the anal veins of the Diptera:—"In most Diptera the first anal vein is wanting as a distinct vein but in many there is a suture-like line, the anal furrow, immediately back of cubitus and closely parallel with this vein; this is a vestige of the first anal vein; this furrow is represented in several of the figures in this chapter by a dotted line. The first anal vein is retained, however, in certain Asilidae; where, although some-

what shortened, it is a distinct vein extending from the base of the wing to near the point where vein *Cu* forks. The second anal vein is the most persistent of the three anal veins; it is well preserved in many families; and is represented in several of the figures in this chapter. The third anal vein is well-preserved in comparatively few forms, although a vestige of it exists in many. It is well preserved in *Tipula* and is fairly, well preserved in *Stratiomyia*." This is an excellent, concise, general statement of the anal region of the dipterous wings as I understand it.

There are several features existing in the proximal end of the wings of Diptera not included in the above account. It is unfortunate that the expense of reproducing figures is such that figures cannot be included, as the structures to be described have not been figured. They will soon be shown, however, in a number of wings in a morphological text-book to be printed soon, it is hoped. An examination of the proximal portion of almost any tipulid wing, as *Tipula cinctans*, shows a long area behind *R+M*. There is extending into this area three long spurs, two of which, if they are represented upon figures, are usually shown as extending obliquely toward *R+M* with which they are usually shown as fused. They are never fused,* however, so far as I have observed, but their direction and position are due to folds in the wing membrane which they support. The first spur extends from opposite the proximal end of cubitus and the caudal end of the arculus. It is always present in the Tipulidae. The second spur is always much longer than the first and while it is found in all Tipulidae it is also distinct in many other Diptera, as for example, *Culex*, *Dixa*, *Rhyphus*, *Leptis*, *Tabanus* and *Eristalis*. The second spur appears, particularly in the Tipuloidea, as a continuation of the second anal vein. The third so-called spur, which is frequently long, especially so in *Tipula*, is generally omitted from figures and appears to be a direct continuation of the third anal vein. The first two of these so-called spurs are true spurs and may be known as the cubital and anal spurs respectively, but the other projection represents the combined cubitus and three anal veins.

In *Tipula* a cross-vein-like structure extends from cubitus

to the second anal vein opposite the caudal end of the arculus. This apparent cross-vein is considered as the continuation of the stem of cubitus. Comstock has shown in the case of *Sialis* and other species from a study of pupal wings that this is the actual course of cubitus. That such must be the course of cubitus in the Diptera seems self-evident. This transverse part of cubitus is not always located opposite the arculus but may be situated distinctly nearer the proximal end of the wing, as in *Cladura* and *Tricyphona*. In *Rhyphus*, *Scenopinus* and *Hilaria*, where the cubital spur is not represented, the transverse part of cubitus has changed its course and extends lengthwise of the wing. *Eulonchus*, *Midas* and *Eristalis* show an almost complete suppression of the transverse part of cubitus and a large anal spur continuous with cubitus and the second anal vein. The Tanyderidae, particularly *Tanyderus* and *Protoplasa*, show an entirely different modification of this region so far as I have studied it. The cubital spur is as a rule not present while the transverse part of cubitus has been suppressed by the anastomosis of the second anal vein with the longitudinal part of cubitus at the caudal end of the arculus.

The first anal vein in the Diptera is frequently a distinct vein in the Nematocera, particularly at its point of origin, sometimes extending nearly to the margin of the wing and usually to or beyond the cubital fork. The enlarged proximal portion of this vein, which is always vein-like, usually arises from the angle formed by the union of the transverse part of cubitus and the second anal vein, sometimes from the second anal vein. The fact that it has actual origin from the transverse part of cubitus is sufficient to disqualify it as a furrow and to prove Comstock's contention that it is a true vein. If it is a true vein, it cannot be other than the first anal vein. Through the changes in the position and direction of the transverse part of cubitus in the Brachycera and Cyclorrhapha, there is apparently a change in the origin of the first anal vein. An examination of such wings as *Leptis* and *Tabanus*, however, leaves no doubt that even in the specialized Diptera, the first anal vein arises from the transverse part of cubitus.

There is no question that the anal spur is a spur formed on

the angle of the combined cubitus, first and second anal veins in the wings of the Tipulidae where the three proximal projections extending into the area on the caudal side of $R+M$ are usually present. That the single projection usually figured as a continuation of cubitus in the wings of the specialized Diptera is homologous with the anal spur in the Tipulidae is easily proven by an examination of the wings of such genera as *Rhyphus*, *Eulonchus*, *Hesperinus*, *Eristalis*, *Midas*, *Scenopinus*, *Hilaria*, *Psilopus*, *Conops*, *Stratiomyia* and *Erax*, where the third so-called spur, the stem of $Cu+A$ is present. The A of the formula just used is the equivalent of 1st $A+2nd A+3rd A$ and is always used in this sense.

In many Tipulidae there is, near the caudal end of the transverse part of cubitus, another transverse cross-vein-like structure, which is here homologized as $Cu+1st A+2nd A$. In the genera named in the preceding paragraph there is some variation in the portion of the caudal vein preserved; in *Rhyphus*, for instance, the distal part of 3rd A is distinct and the proximal portion represented by folds, while in *Erax* and *Scenopinus* the combined proximal portion is distinct and the most of the distal portion of 3rd A has disappeared.

The wings of *Protoplasa fitchii* and other tauyderids show three anal veins, as already stated, and not a single one as the figure of Osten-Sacken would suggest. The first anal is of the same distinctness as this vein in the Tipulidae and was undoubtedly considered as a fold and for this reason omitted from the figure. The cubital spur is wanting and the anal spur is long. The stem of $Cu+A$ is prominent while the free part of the third anal vein is short; instead of extending toward the distal end of the wing, it extends obliquely proximad in line with the cross-vein-like portion of the fused $Cu+1st A+2nd A$.

The correctness of this interpretation of the relation of the cubital and anal veins of the proximal end of the wing rests or falls upon the question whether the transverse cross-vein-like vein opposite the caudal end of the arculus in the Tipulidae is the continuation of the stem of cubitus or not. Comstock shows such a modification of the base of cubitus in the Tri-

choptera, Micropterygidae, and Hepialidae. I believe that a similar switching has occurred in the Diptera and that the veins of the anal region should be homologized as stated above. Unfortunately the pupal wings offer no corroborative evidence in this order, since the tracheae do not map out the course of the veins.

I am especially indebted to Dr. Charles P. Alexander, of the Massachusetts Agricultural College, for an opportunity to study his very extensive collection of mounted wings of Tanyderidae and Tipulidae.

Observations on the Occurrence and Biology of *Triatoma flavida* in Cuba (Heterop. : Reduviidae).

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In March, 1922, Dr. S. C. Bruner, Entomologist of the Agricultural Station of Santiago de las Vegas, published a notice that he had received from the eastern part of Cuba a Reduviid, which he had identified as *Rhodnius prolixus* Stål. The notice attracted my attention because the Reduviids, especially *Triatoma conorhinus* (formerly *Conorhinus megistus*) and *Rhodnius prolixus* are known as natural carriers of human trypanosomiasis in South America, and I had been seeking for those Reduviids in Cuba for some time, though I was informed by experts that they do not exist here, also that the disease just mentioned is not observed in Cuba.

It seems really that this insect is very rare in Cuba. Besides the one or two specimens of Dr. Bruner, I have been able to obtain one more from the same source. But all the other attempts, to get animals or any notice about them, failed. There is no doubt, however, that the animal belongs to the fauna of Cuba, because it is already found in the well-known collection of the Museo Gundlach of Habana. Lately I heard of its occurrence in the provinces of Camaguey and Santa Clara. Recent information from the U. S. National Museum in Washington, however, is to the effect that it is really *Triatoma flavida*, described by Neiva in 1912 from the type in the Museum in Washington.